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(54) **Paper and board**

(57) Paper or board comprises, an organic fibre, e.g. cellulose, an inorganic fibre, e.g. glass or mineral wool, and sodium or potassium silicate as a binder. It may also contain other components, in particular carbamide or propylene glycol.

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SPECIFICATION

Fibre product, such as paper, cardboard or the like, and method of manufacturing such product

The present invention relates to a new type of fibre product, such as paper, cardboard or the like, and a method of manufacturing such product based on a suspension of treated organic and inorganic fibres.

The use of compounds of silicic acid and sodium or potaassium, i.e. water-glass, is already familiar as a substitute for organic binders in the manufacture of paper. However, the use of water-glass as a binder has often given paper of brittle structure and poor tear strength, and for this reason water-glass has not been commonly used as a binding-agent for cellulose fibres in paper manufacturing.

The use of inorganic fibres, as glass fibre, in paper manufacturing is also familiar to the art, either alone or in combination with fibres of cellulose or other organic substance.

One major objective of the invention is the manufacture of fibrous products having good wet strength and low porosity through the combination of water-glass - perhaps modified by the addition of some conventional binding-agent, organic or inorganic - inorganic fibres, such as fibres of mineral wood, and organic fibres, e.g. cellulose fibres. Such combination of organic and inorganic fibres with a binding-agent improves both wet strength and porosity properties, which the use of cellulose fibres alone will not permit. Fibre products made according to the method of the invention also display excellent water-repelling properties. If a high percentage of mineral wool is added, first-rate fire-retarding qualities are achieved along with excellent thermal stability. Furthermore, such products are resistant to mould, and micro-organisms are unable to gain a hold on their surface, meaning that they would be suitable for, say, clinical work. The new product shows, too, excellent resistance to wear and to impact and tensile stresses. With the use of glass fibre and water-glass, known for their dielectric properties, the product is also provided with a degree of electrical insulation able to meet the most stringent requirements. Shrinkage and contraction are insignificant.

Fibre products manufactured according to the method of the invention are produced from a suspension of treated cellulose fibres to which is added a binding-agent of water-glass. Finally, mineral wool fibres, also in the suspension phase, are added to the suspension of cellulose fibres whereupon the final suspension, or stock, after undergoing further treatment, e.g. the admixture of size, dyestuff, filler and thickener, is dried and pressed to obtain the final product. Glass fibres having a diameter of approx. 7µm - standard fibres as used for building insulation - may be used to advantage in the new method.

It has also proved quite possible to use edge waste and rejected material from the manufacture of mineral wool as an admixture, and good results have been obtained.

The water-glass binder may consist of compounds of silicic acid and sodium or potassium to which carbamide and/or propylene glycol have been added. Good results have been obtained by using e.g. sodium silicate where the mole proportion between sodium oxide and silicon dioxide is 1:3.4-4.1. The water-glass binding agent may, furthermore, be modified by some conventional organic or inorganic binder.

The cellulose pulp, which may be bleached or unbleached, used in the manufacture of the product is prepared in advance so as to increase the specific surface of the fibres and allow them to make good contact during the forming of the sheet. This is carried out by conventional means, by mechanical agitation, or "beating", in pulpers, jordan refiners or similar grinding machinery. During this process the cellulose fibres are made somewhat shorter and the fibre bundles are delaminated. Birch, pine or spruce, for example, may be used for the cellulose pulp. In the new method such pulp is suspended in a separate water chest, the mineral wool fibres, from e.g. sheets, slabs or flocs of mineral wool, being suspended in another. Here, as mentioned above, rejects or waste material may be used to advantage. The water-glass binding-agent is then added to the chest containing the cellulose pulp, after which the contents of the two chests are mixed. The mixture so obtained, the stock, may then be treated by conventional means, by e.g. the admixture of size, dyestuff, filler and thickener, before continuing to the drying and pressing stages.

Example 1

Glass fibres and water are mixed in a pulper for 5 minutes to obtain a suspension or slurry, the amount of glass fibre contained being ten percent by weight of the whole. Here it is worth mentioning that slurries of cellulose fibres usually contain approx. 3 - 3.5 percent cellulose by weight, thus entailing a fairly high water content when the product is removed to the wire for dewatering. A pulp containing a certain amount of glass fibres dries out much faster in the paper machine than does a pure cellulose pulp, and this has economic advantages, for the manufacturing process can thereby be speeded up.

After mixing, the glass fibre slurry is removed to a stock chest.

A three percent cellulose fibre slurry of bleached birch is prepared in another stock chest. To this is added 5% sodium silicate binder calculated on the total amount of glass fibre and cellulose slurry, having a ratio of 3.4 and containing carbamide and propylene glycol. The purpose of this binding-agent of water-glass is, on the one hand, to reduce the wettability of the fibres, i.e. to make them more resistant to water, on the other to reduce their pore radius, that is to fill in the pores in the sheet, thereby reducing pore diameter and hindering the penetration of liquids.

The glass fibre slurry is then added and mixed with the slurry of cellulose fibres and water-glass, the amount of glass fibres contained in the whole being ten percent by weight. This mixture of cellulose fibres, glass fibres and water-glass binder is alkaline, i.e. its pH value is between 9.0 and 9.5. For

comparison we may mention that the pH value of cellulose fibres is usually 4.5 at this stage. No hydrophobic agent or alun is added to the slurry, nor is the temperature raised as in conventional manufacturing methods.

The slurry mixture so obtained in then passed through a conical refiner and out onto a wire via the head box of a paper machine as in conventional methods.

A fibre product manufactured by the method described above has several advantages, above all in that its tearing resistance and printability, for e.g. process printing, are excellent, a result of good dimensional stability between the fibres. The quality of the product is also well-suited to packaging purposes since deformability is good.

Example 2

This test was carried out in exactly the same way as that described in Example 1 but used instead of 30% admixture of mineral wool fibres, 10% water-glass binder and 60% cellulose fibres.

Since the percentage of mineral wool was higher, drying was quicker than in the first example.

The paper obtained displayed good dielectric qualities and good resistance to wear and to impact and tensile stresses. Shrinkage and contraction were insignificant.

Example 3

This was carried out in the same way as the two previous tests, although here the proportions of the components were different. In this case, 90% mineral wood fibres were mixed with 5% water-glass binder and 5% cellulose fibres.

The paper made by this method proved to have high resistance to combustion and burning, had high thermal stability and was, furthermore resistant to mould.

Example 4

The fourth test, which was also carried out in the same way as the others, included 50% mineral wool fibres, 10% water-glass binder, 5% melamine resin and 35% cellulose fibres.

Characteristics found specifically in this type of paper were good folding properties and a very smooth surface.

As is apparent from the examples, paper types of differing properties may be obtained by varying the proportions of mineral wood fibres, cellulose fibres and water-glass binder. Thus, by using a high percentage of mineral wool fibres in the mixture - tests were made with admixtures of up to 95% by weight - paper can be made having exceptionally fine fire-retarding properties.

Tests were also carried out, and good results were obtained, with an admixture of 30% by weight water-glass binder.

Various different types of paper were produced in the examples discussed above. However, the invention is not limited only to fibrous products in the form of relatively thin sheets such as cardboard or the like, but may well be applied to products in the form of felt having a thickness of several centimeters.

In the examples discussed above carbamide and propylene glycol were added with the binder, but these can naturally also be added to the suspension separately.

CLAIMS

1. Fibre product, e.g. paper, board or the like, characterized in that besides organic fibres it contains inorganic fibres, a binding-agent at least partly in the form of compounds of silicic acid and sodium or potassium and carbamide and/or propylene glycol.

2. Fibre product of claim 1, characterized in that the inorganic fibres are of mineral wool.

3. Fibre product of claims 1 and 2, characterized in that the fibres of mineral wool amount to between 1% - 95% of the weight of the fibre product.

4. Fibre product using a water-glass binder of claim 1, characrerized in that the water-glass binder is modified by an organic binding-agent.

5. Fibre product using a water-glass binder of claim 1, characterized in that the water-glass binder is modified by an inorganic binding-agent.

6. Method of manufacturing a fibre product containing fibres of cellulose and mineral wool based on a suspension of treated cellulose fibres, in which the binding-agent for the fibres at least in part contains compounds of silicic acid and sodium or potassium and carbamide and/or propylene glycol, as per claim 1, characterized in that the water-glass and mineral wool fibres are added to the suspension of cellulose fibres, whereupon the suspension or stock and its additives, after further treatment by e.g. the addition of size, dyestuff, filler and thickener, is dried and pressed to obtain the final product.

7. Method of claim 6, characterized in that the water-glass is added in such quantities that it accounts for approximately 1% - 30% by weight of the fibre suspension as a whole.

8. Method of claim 7, characterized in that the water-glass is added directly to the suspension of cellulose fibres and that the fibres of mineral wool are added in the form of a separate fibre suspension.

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